

Memory conformity of autobiographical events: an fmri study



Whether privately, when we remember a past experience, or publicly, when we recall a shared memory with a friend, remembering is a functional process. The narratives of our past help us define and maintain our sense of self and meet the social demands of the community (Barnier, Sutton, Harris, & Wilson, 2008; Harris, Paterson, & Kemp, 2008). However, far from being exact replications of the past, our recollections may be influenced by previous knowledge and imagination, external demands and internal expectations, and exposure to subsequent information (Dudai & Edelson, 2016; Schacter, Guerin, & St. Jacques, 2011). Memory, indeed, is a constructive process (St Jacques, Olm, & Schacter, 2013). While the malleability of our memories is a necessary feature for an adaptive memory system, both psychological and neuroscientific research in the false memory literature has consistently shown that the flexibility of our memory processes also render memories vulnerable to errors and distortions (Loftus, 2005; Loftus & Pickrell, 1995; Schacter et al., 2011; Schacter & Loftus, 2013; St Jacques et al., 2013). Extensive research has indeed demonstrated the detrimental effects that incorrect or misleading post-event information has on the content of memory reports, a phenomenon called ‘the misinformation effect’ (Loftus, 2005). In the classical misinformation paradigm, participants are asked to remember an event, take a memory test that contains some kind of misinformation, and then complete a final memory test for the original event. Across experiments results have consistently shown that after receiving the misinformation, participants in the final test tend to change the content of their memory or even endorse a memory for an event that never happened (Frenda, Nichols, & Loftus, 2011; Loftus, 2005; Loftus & Pickrell, 1995). Typically, researchers have explained this phenomenon in accordance <https://assignbuster.com/memory-conformity-of-autobiographical-events-an-fmri-study/>

with a source-monitoring framework that sees false memories as arising from participants' erroneous attribution of the misinformation to the original event (Johnson, 1997). Recent research on the misinformation effect with functional magnetic resonance imaging (fMRI) has started to reveal the underlying mechanisms that support false memory formation (Frenda et al., 2011; Schacter & Loftus, 2013). Although with some degree of variation mostly accounted by different experimental procedures, neuroimaging studies have shown that brain activity associated with encoding-related processes particularly in the hippocampal complex during the original event and misinformation phase is predictive of whether the misinformation would be later endorsed (Baym & Gonsalves, 2010; Okado & Stark, 2005; Schacter & Loftus, 2013; St Jacques et al., 2013). These studies point to the adaptive perspective of memory. Although different pattern of activation do seem to distinguish true from false memories, the misinformation effect found in behavioral studies seem to arise from a flexible memory system that through reactivation and reconsolidation is responsible for memory updating (Schacter et al., 2011; Schacter & Loftus, 2013; St Jacques et al., 2013). Thus, the misinformation effect is a byproduct of functional memory processes that allow the incorporation of new information but are susceptible to memory errors (Dudai & Edelson, 2016; Frenda et al., 2011; Schacter et al., 2011; St Jacques et al., 2013).

Given the powerful influence and adaptive value that post-event information has on memory, recent research has increasingly begun to explore the misinformation effect when the incorrect information comes from other people, i. e. the source of the misinformation is social (Oeberst & Seidemann,

2014; Schacter & Loftus, 2013). In numerous real-world contexts, ranging from the exposure to mass media, social interactions, and eyewitness testimony, remembering an event involves sharing information with other people (Edelson, Sharot, Dolan, & Dudai, 2011). While sharing information enhances individual memory performance when events are encoded poorly, in others circumstances, especially when incorrect information is shared, collective remembering is likely to produce memory errors (Harris et al., 2008; Hirst & Echterhoff, 2012; Rajaram & Pereira-Pasarin, 2010). Indeed, research converging experiments on social conformity and the misinformation effect have provided extensive evidence supporting the idea that people change their memory reports in response to incorrect information from a social source, a phenomenon often referred to as ‘memory conformity’ (Dudai & Edelson, 2016; Gabbert, Memon, & Allan, 2003; Gabbert, Memon, & Wright, 2006; Horry, Palmer, Sexton, & Brewer, 2012; Jaeger, Lauris, Selmeczy, & Dobbins, 2012; Meade & Roediger, 2002; Roediger, Meade, & Bergman, 2001; Thorley, 2013; Wright, Self, & Justice, 2000; Wright, Memon, Skagerberg, & Gabbert, 2009). Memory conformity represents a special kind of misinformation effect that exerts strong influence on memory reports – a study has found that participants were more likely to report the misinformation when the incorrect information came from discussion with a confederate as opposed to when it was included in narratives (Gabbert, Memon, Allan, & Wright, 2004) – and has high ecological validity. Not only has research found that about 86% of eyewitnesses have reported talking to another person before providing their testimony but also cases have been documented in which co-witness sharing of information has led to the wrongful conviction of a suspect (Oeberst & <https://assignbuster.com/memory-conformity-of-autobiographical-events-an-fmri-study/>

Seidemann, 2014; Thorley, 2013; Wright et al., 2000; Wright et al., 2009). Although participants may change their memory reports in the presence of social pressure due to normative influences (i. e., participants report the incorrect information solely out of the need to comply with others) and informational influences (i. e., participants report the incorrect information because they believe the others to be right), the literature on the misinformation effect suggests that memory conformity may arise from false memory formation (Gabbert et al., 2003; Meade & Roediger, 2002; Oeberst & Seidemann, 2014; Roediger et al., 2001; Wright et al., 2009). Studies have in fact shown that participants tend to report the incorrect information even in later memory tests, where participants are tested individually in the absence of social pressure, and misattribute the endorsed misinformation to the original event (Meade & Roediger, 2002; Roediger et al., 2001). Evidence to the false memory account also comes from neuroimaging studies that have tried to identify the neural correlates involved in memory conformity. In an fMRI study by Edelson, Sharot, Dolan, and Dudai, (2011), groups of five participants were shown a video of a mock crime and were tested three times on the content of their memory across two weeks. Critically, in the second test, the researchers manipulated the misinformation by showing participants either fake incorrect answers of the four co-observers or no answers. Consistent with previous research on the misinformation effect, greater activity in encoding-related regions, specifically the bilateral anterior hippocampus, bilateral posterior hippocampus and bilateral parahippocampal gyrus was found for trials that resulted in erroneous answers even in the absence of social pressure but not for trials that resulted in errors due to social pressure or in correct answers. The researchers also

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found increased activity in the bilateral amygdala, a region involved in social-emotional processing, and increased functional connectivity between this region and the hippocampus in persisting memory conformity errors (Edelson et al., 2011). Not only these results indicate that participants updated their memory when they received the misinformation, replicating previous neuroimaging results, but they also reveal the role of the amygdala in the integration of social-specific information in memory (Dudai & Edelson, 2016; Edelson et al., 2011).

For its high relevance to the forensic context, past research on memory conformity has focused on studying the social forces that influence memory reports mainly in the field of eyewitness testimony (Gabbert et al., 2003; Harris et al., 2008; Horry et al., 2012; Jaeger et al., 2012; Oeberst & Seidemann, 2014; Williamson, Paul; Weber, Nathan; Robertson, 2013; Wright et al., 2009). The effects of social forces on the content of autobiographical memories, however, represent an area of research that seems to have been neglected by the literature on memory conformity (Barnier et al., 2008).

Autobiographical memories are memories of personal experiences, commonly accompanied with high personal and sometimes emotional relevance (Harris et al., 2008). Given the role that autobiographical memories have in individual and community-directed behavior, as we selectively remember events that help us maintain our individual and group identity, and their occurrence in social interactions, as people usually share their memories in conversation when they remember a past experience (Dudai & Edelson, 2016; Harris et al., 2008; Rajaram & Pereira-Pasarin, 2010; Zawadzka, Krogulska, Button, Higham, & Hanczakowski, 2015), the present

study attempts to study the susceptibility of autobiographical memories to social influences that create memory errors and distortions. Previous studies on false memories provide, perhaps unintentionally, some evidence for the endorsement of misinformation coming from social sources, whether implicitly through questionnaires created by the experimenter or explicitly by specifically informing the participants about the source of the misinformation (Hirst & Echterhoff, 2012). Indeed, in Loftus and Pickerell's (1995) notorious 'lost in the mall' paradigm, 29% of participants came to form a completely false memory about being lost in a mall when they were children. Critically, the false event was firstly introduced through narratives from a close relative (Hirst & Echterhoff, 2012; Loftus & Pickrell, 1995). In recent attempts to understand the effects of social influence on autobiographical memories, a study has directly manipulated the presence of a social source, by introducing a piece of misinformation about a participants' personal memory during conversation with a confederate. The study found that a week after receiving the misinformation from the confederate, about 30% participants included the misinformation in their final description of their memory (Barnier et al., 2008). Together, these findings suggest that rich autobiographical false memories might indeed be influenced by post-event information introduced by social actors (Harris et al., 2008).

The present study thus aims at understanding the cognitive mechanisms of memory conformity for autobiographical memories using fMRI. The experiment will adapt a novel 'museum tour' paradigm used by St Jacques et al. (2013), which allows the control over the encoding of real-world events and measures of memory accuracy, to study the neural mechanisms

involved in the influence of post-event information on autobiographical memories to the previously described memory conformity procedure used by Edelson et al. (2011). Studying the neural mechanisms involved in memory conformity for personal events has indeed methodological, theoretical, and applied valence. From a methodological perspective, the memory conformity procedure used in Edelson et al. (2011) study and the ‘museum tour’ paradigm used in St Jacques et al. (2013) will offer new ways to systematically study both autobiographical memories using fMRI and their susceptibility to social influences. Understanding the mechanisms involved in the integration of social information in autobiographical memories will extend our theoretical knowledge on the flexibility of our memory system responsible both for the formation of false memories and adaptive memory updating. Finally, studying the mechanisms involved in the effects of social influences on autobiographical memories will also expand the memory conformity literature to the real-world examples of personal memories, critical for the forensic context where jurors are asked to judge eyewitness memory reports of personally relevant events (Schacter & Loftus, 2013).

Based on previous research reviewed above, the following predictions are hypothesized. Behaviorally, trials where the misinformation is introduced by fake co-observers’ answers will produce errors that are likely to persist even when participants are tested individually (persistent errors) (H1).

Neuroimaging data will show greater activity in the hippocampal complex for the social misinformation condition opposed to the no-misinformation condition (H2). Additionally in the social manipulation condition, greater hippocampal activity will be measured for trials that produce errors that

persist in the absence of social influences compared to trials that produce errors only in the presence of co-observers' answers (transient errors) or trials where no conformity is produced (H3). Finally, the special role of the amygdala in the integration of social information will be also studied. More hippocampus-amygdala connectivity for persistent errors produced by the social-manipulation condition is expected when contrasted with transient errors and the control condition (H4).

Methods

Participants

Forty right-handed participants will be recruited through the University of Kent Research Participation Scheme. Participants with history of psychiatric disorder or using medication known to affect cognitive functioning will be excluded.

Design & procedure

The study is a within-participants design, divided into four phases, specifically an encoding phase, a first memory test (Test 1), a manipulation phase (Test 2), and a final memory test (Test 3) (Edelson et al., 2011).

Encoding phase (day 0): Groups of five unacquainted participants will be provided with an iTouch (Apple) outlining a self-guided audio tour of the British Museum (London, UK) and will be asked to wear a camera that automatically takes photographs every 15 seconds (St Jacques et al., 2013).

There will be two slightly different versions of the museum tour, each

composed by 208 stops, which will be counterbalanced between groups of participants.

Test 1 (day 3): Participants will take a first forced-choice memory test individually for the museum tour. They will be shown two photographs (A & B) for every museum stop; one taken from the version of the tour they have experienced, the other from the alternate tour they have not experienced. The photographs will be matched for every stop between the two versions. They will be then asked to choose the museum stop they remember taking part in and to rate their confidence from 0 (guess) to 100 (absolute confidence). Answers will provide the baseline for accuracy and confidence before the manipulation.

Manipulation phase – Test 2 (day 7): Participants will be asked to take a second individual memory test in the fMRI scanner. The test will be similar to Test 1 but after the photographs' presentation and before participants' response, another screen will appear with the pictures of the co-observers. For the photographs of museum stops that received a high confidence correct answer in Test 1, co-observers pictures will be presented with either all incorrect answers (manipulation condition), all correct answers (credibility condition), or an ' X' replacing the answers (no manipulation condition). The credibility condition helps to avoid suspicion from participants, will contain different photographs taken from all the questions in Test 1 and will be excluded from analysis.

Test 3 (day 14): Participants will take a final individual memory test identical to Test 1 in the scanner. Before the test, participants will be warned that the answers provided by the co-observers in Test 2 were randomly generated.

Materials

All stimuli and materials will be taken from St Jacques et al. (2013) and adapted for the purpose of the present study.

Analysis

The following analyses are based on Edelson et al. (2011)'s study (see supplementary information).

Behavioral data

A repeated measure GLM with error type (transient errors, persistent errors, non-conformity, and no manipulation) as a factor will be conducted.

Transient errors: trials where the social manipulation was introduced and for which participants give a first correct answer (Test 1), an incorrect answer in Test 2, and revert back to the correct answer in Test 3. Persistent errors: trials where the social manipulation was introduced for which participants give a first correct answer in Test 1 but an incorrect answer in both Test 2 and 3. Non-conformity: trials where the social manipulation was introduced and for which participants give a correct answer in both Test 2 and 3. No manipulation: trials where co-observers' answers will not be given.

Neuroimaging data

Region of interest analysis: activity in previously identified regions of interest (ROI) (i. e., bilateral amygdala, bilateral para-hippocampus and bilateral anterior and posterior hippocampus) will be analyzed with repeated measures GLM with error type (persistent errors, transient errors, non-conformity, and no manipulation) as a factor.

Functional connectivity analysis: whole brain analysis will be conducted to measure functional connectivity between activated ROIs and the left amygdala across experimental conditions.

Why fMRI?

Reasons why other methods are not appropriate – The primary interest of this study is to identify the underlying neural mechanisms that support the long-lasting integration of new and sometimes incorrect information about personal events in memory as a function of social influence. Although the study takes advantage of measures of accuracy and error rates, the primary interest is not in measuring overt behavior, so behavioral methods (i. e., reaction times), are not appropriate. Behavioral studies have in fact been unable to distinguish between the different cognitive processes (i. e., normative influences, informational influences, and memory distortions) that lead to memory conformity (Edelson et al., 2011; Thorley, 2013). Similarly eye tracking is not an appropriate method either. Although measures of eye-fixation and eye-movement during the presentation of misinformation could be informative about attentional processes that lead to successful encoding, these measures cannot distinguish between different cognitive processes that support memory conformity. This study does not intend to measure

neuronal activity, so methods of electrical activity, namely EEG and ERPs, are not appropriate. Although they could be informative about the time when integration processes happen, measures of electrical activity cannot tell us where these processes are supported functionally in the brain. Finally, the present study does not aim at manipulating brain activity as it focuses on understanding the automatic online processes that are associated with memory conformity, so methods of brain stimulation (i. e., TMS) are not appropriate.

Reasons why fMRI is appropriate – As the present study aims at understanding the cognitive mechanisms involved in the integration of post-event, social misinformation that lead to memory conformity for autobiographical memories, fMRI represents the most appropriate method. Measures of brain activity in encoding-related regions during the presence of misinformation from a social source can provide information about the cognitive processes associated with memory conformity for personal events and distinguish between social influences (i. e., normative or information) and memory distortions that lead to false autobiographical memory reports. Previous studies have in fact shown that activity in the hippocampal complex at encoding is predictive of whether the misinformation will produce long lasting memory change (Edelson et al., 2011; St Jacques et al., 2013). Similarly, identifying the functional architecture of the encoding processes that support the integration of social information in memory will reveal the cognitive mechanisms underlying memory updating, which make memories flexible and vulnerable to social influences (Schacter et al., 2011). Because

of its non-invasiveness and better temporal resolution, fMRI is more suitable than other measures of brain activity, such as PET.

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